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Ver. x

November 3, 2005

Our File: 2200-001 US

Assistant Commissioner of Patents
United States Patent and Trademark Office
Randolph Building
401 Dulany Street
Alexandria, VA 22314

via courier

Dear Sir:

RE: US Patent Application – **10/668,266**
Title – **METHOD AND APPRATUS FOR DESANDING WELLHEAD PRODUCTION**
Filing Date – September 24, 2003
Priority - US 60/417,146 of Oct 10/02; CA 2,407,554 of Oct 10/02 & CA 2,433,741 of Jun 27/03
Inventors – Hemstock et al.

Enclosed please find a certified copy of each of the following priority documents to be filed for the abovenamed application:

Canadian Application 2,407,554; and
Canadian Application 2,433,741.

Yours truly,

Sean W. Goodwin
SWG/lmt

Encl. 2 certified copies

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ments déposés au Bureau des brevets.

This is to certify that the documents
attached hereto and identified below are
true copies of the documents on file in
the Patent Office.

Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,407,554, on October 10, 2002, by **CHRISTOPHER A. HEMSTOCK**,
BRUCE G. BERKAN and **KEVIN D. PRICE**, for "Method and Apparatus for
Desanding Wellhead Production".

**CERTIFIED COPY OF
PRIORITY DOCUMENT**

Deacy Pauls
Agent certificateur/Certifying Officer

November 2, 2005

Date

Canada

(CIPO 68)
31-03-04

OPIC  CIPO

1 **"METHOD AND APPARATUS FOR**
2 **DESANDING WELLHEAD PRODUCTION"**

3
4 FIELD OF THE INVENTION

5 The present invention relates to apparatus and methodology for the
6 removal of particulates such as sand from fluid streams produced from a well while
7 minimizing erosion of the involved equipment.

8
9 BACKGROUND OF THE INVENTION

10 Production from wells in the oil and gas industry often contain
11 particulates. These particulates could be part of the formation from which the
12 hydrocarbon is being produced, introduced particulates from hydraulic fracturing or
13 fluid loss material from drilling mud or fracturing fluids or from a phase changes of
14 produced hydrocarbons caused by changing conditions at the wellbore (Asphalt or
15 wax formation). As the particulates are produced, problems occur due to abrasion,
16 and plugging of production equipment. In a typical startup after fracturing, a
17 stimulated well may produce sand until the well has stabilized, sometimes up to a
18 month.

19 In the case of gas wells, fluid velocities can be high enough that the
20 erosion of the production equipment is severe enough to cause catastrophic failure.
21 High velocities are typical and are even designed for elutriating particles up the well
22 and to the surface. An erosive failure of this nature can become a serious safety and
23 environmental issue for the well operator. In all cases, particulate production

1 contaminates surface equipment and produced fluids and impairs the normal
2 operation of the oil and gas gathering systems and process facilities.

3 In one prior art system, a pressurized tank ("P Tank") is placed on the
4 wellsite and the well is allowed to produce fluid and particulates into this tank until
5 sand production ceases. The large size of the tank usually restricts the maximum
6 operating pressure of the vessel to something in the order of 1,000 – 2,100 kPa. In
7 the case of a gas well, this requires some pressure control to be placed on the well
8 to protect the P tank. Further, for a gas well, the pressure reduction usually is
9 associated with an increase in gas velocity which in turn makes the sand laden well
10 effluent much more abrasive. Other problems associated with this type of desanding
11 technique are that it is a temporary solution. If the well continues to make sand, the
12 solution becomes prohibitively expensive. In most situations with this kind of
13 temporary solution, the gas vapors are not conserved and sold as a commercial
14 product.

15 An alternate known prior art system includes employing filters to
16 remove particulates. A common design is to have a number of fibre mesh bags
17 placed inside a pressure vessel. The fibre density is matched to the anticipated
18 particulate size. Filter bags are generally not effective in the removal of particulates
19 in a multiphase conditions. Usually multiphase flow in the oil and gas operations is
20 unstable. Large slugs of fluid followed by a gas mist is common. In these cases, the
21 fibre bags become a pressure drop point and often fail due to the liquid flow through
22 filter. Due to the high chance of failure, filter may not be trusted to remove
23 particulates in critical applications or where the flow parameters of a well are

1 unknown. An additional problem with filters in most jurisdictions is associated with
2 cost of disposal. The fibre bags are considered to be contaminated with
3 hydrocarbons and must be disposed of in accordance to local environmental
4 regulation.

5 Clearly there is a need for more versatile and cost effective system.

6

7 SUMMARY OF THE INVENTION

8 Apparatus is provided which is placed adjacent to the wellhead for
9 intercepting wellhead fluid flow before prior to entry to any operators equipment
10 including separators, valves, chokes and all other downstream equipment.

11 A pressure vessel is inserted in the flowstream by connecting it
12 adjacent to the wellhead and to the input high velocity field piping extending from the
13 wellhead. The vessel contains a freeboard volume having a cross-sectional area
14 which is greater that of the field piping from whence the fluid emanate. As a result,
15 fluid velocity drops and particulates cannot be maintained in suspension. The
16 freeboard cross-sectional area is maintained through a downcomer weir or
17 depending nozzle at the vessel's exit which ensures that a minimum freeboard
18 volume and cross-section area is maintained, a factor in such a goal being to limit
19 the collection of particulates signaling a need to maintain the system.

20

21 BRIEF DESCRIPTION OF THE DRAWINGS

22 Figure 1 is a cross-sectionals side view of one embodiment of the
23 invention;

1 Figure 2 is a photo of a typical installation for portable, trailer-delivered
2 wellsite service; and

3 Figure 3 is a performance graph of the achievable gas rates while still
4 achieving particulate removal.

5

6 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

7 As shown in Fig. 1, a desander comprises a substantially horizontal,
8 cylindrical, pressure vessel having an inlet end adapted for connection to a wellhead
9 piping and fluid stream, typically gas and sand.

10 The inlet comprises a nozzle extending into an upper freeboard volume
11 adjacent the top of the vessel. An eccentric fitting shifts the axis of the vessel
12 downward to form a belly storage portion for receiving and temporarily storing sand.
13 The nozzle extends beyond the end of the vessel and into the freeboard which
14 minimizes localized wear.

15 Gas containing sand enters through the inlet and is received by a
16 larger cross-sectional area of the freeboard. The velocity slows and sand falls out of
17 suspension. The freeboard is maintained using means to ensure that the particulate
18 free fluid is collected from mid-vessel. This is achieved using either a weir as shown
19 or by inserting the outlet nozzle into the vessel, away from the vessel wall.

20 The outlet for the vessel is preferably perpendicular and upward,
21 drawing from the lower level of the freeboard volume.

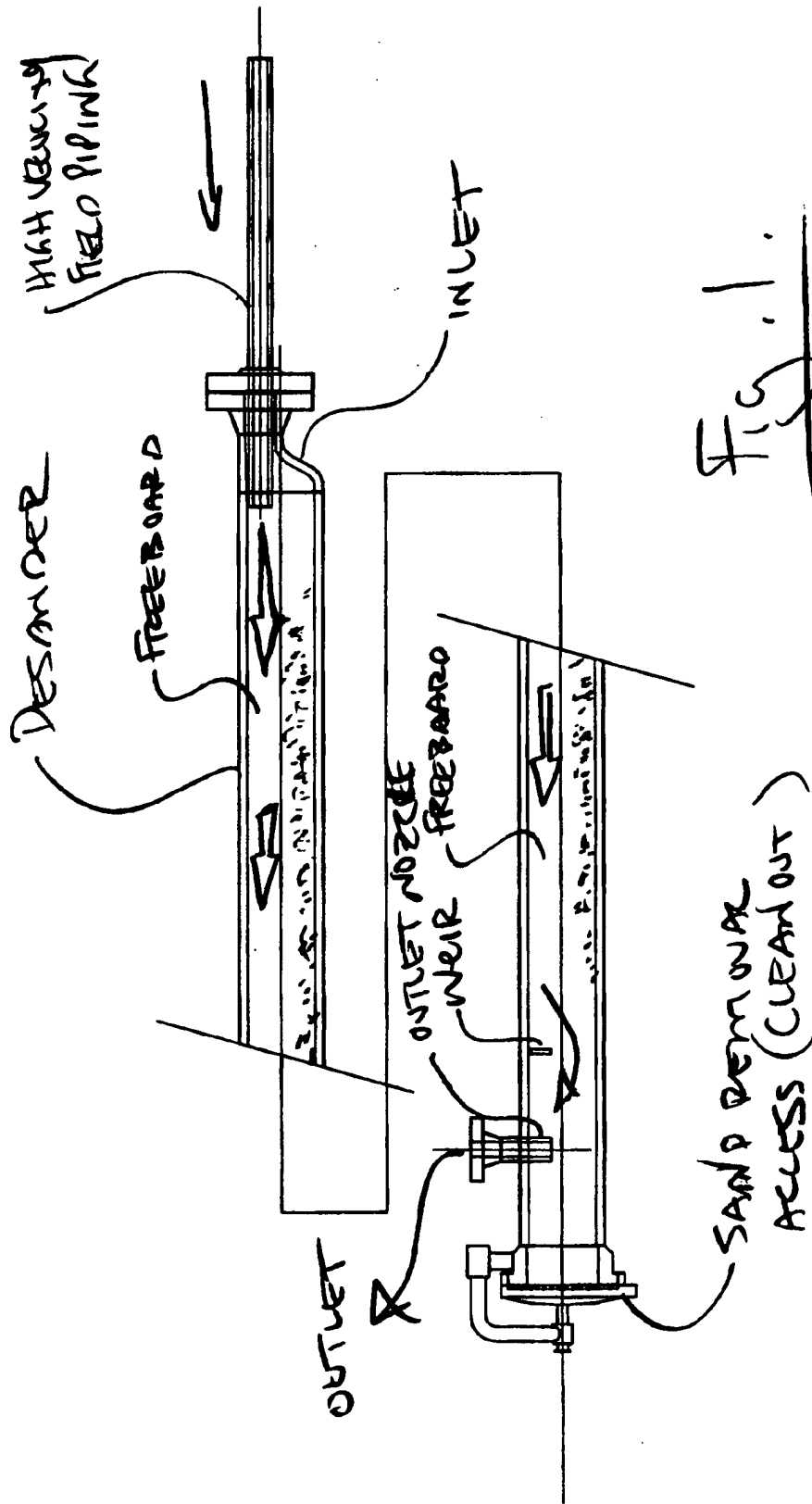
22 A quick release pressure-vessel compatible cleanout is provided for
23 sand removal access. The vessel must be depressurized before opening and

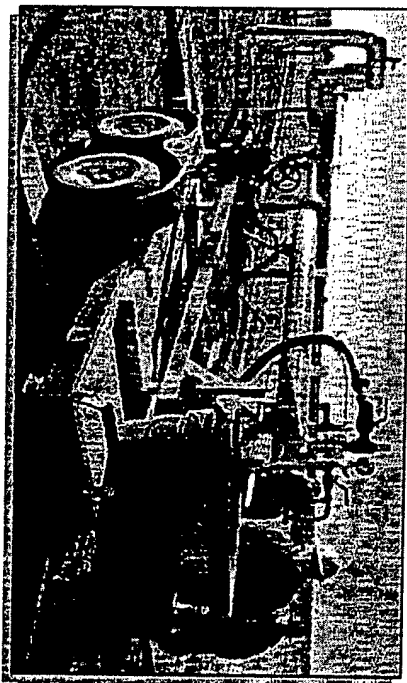
1 cleaning out particulates. Manual cleanout is performed although automated
2 cleanout could be incorporated without diverging from the intent of the invention.

3 A typical vessel may be a 6" diameter, schedule 160 shell having a
4 capacity for 8 million cubic feet of gas per day and a corresponding and typical
5 collection rate of 1.5 gallons of particulates per day.

6 The advantages of the system include:

- 7 • As the desander is more cost effective than a "P Tank", the
8 desander can be economically placed on a well for long term
9 (substantially permanent) sand protection;
- 10 • With a pressure rating that allows it to operate at the wells
11 conditions, minimal pressure drop is experienced across the
12 vessel. The desander is designed to exceed ASME code for
13 pressure vessels. This permits the sand to be removed from
14 the flow stream without becoming erosive.
- 15 • Since the vessel is passive and has no moving parts, plugging
16 caused by particulates is not an issue. Sand is removed
17 mechanically from the vessel at regular intervals. By removing
18 the sand prior to it entering the producing system, contamination
19 of equipment and produced fluids is avoided.
- 20 • The vessel is capable of handling multiphase production and
21 has demonstrated the ability to remove sand from both gas and
22 oil streams. This results in a wider application than the filter
23 methods.



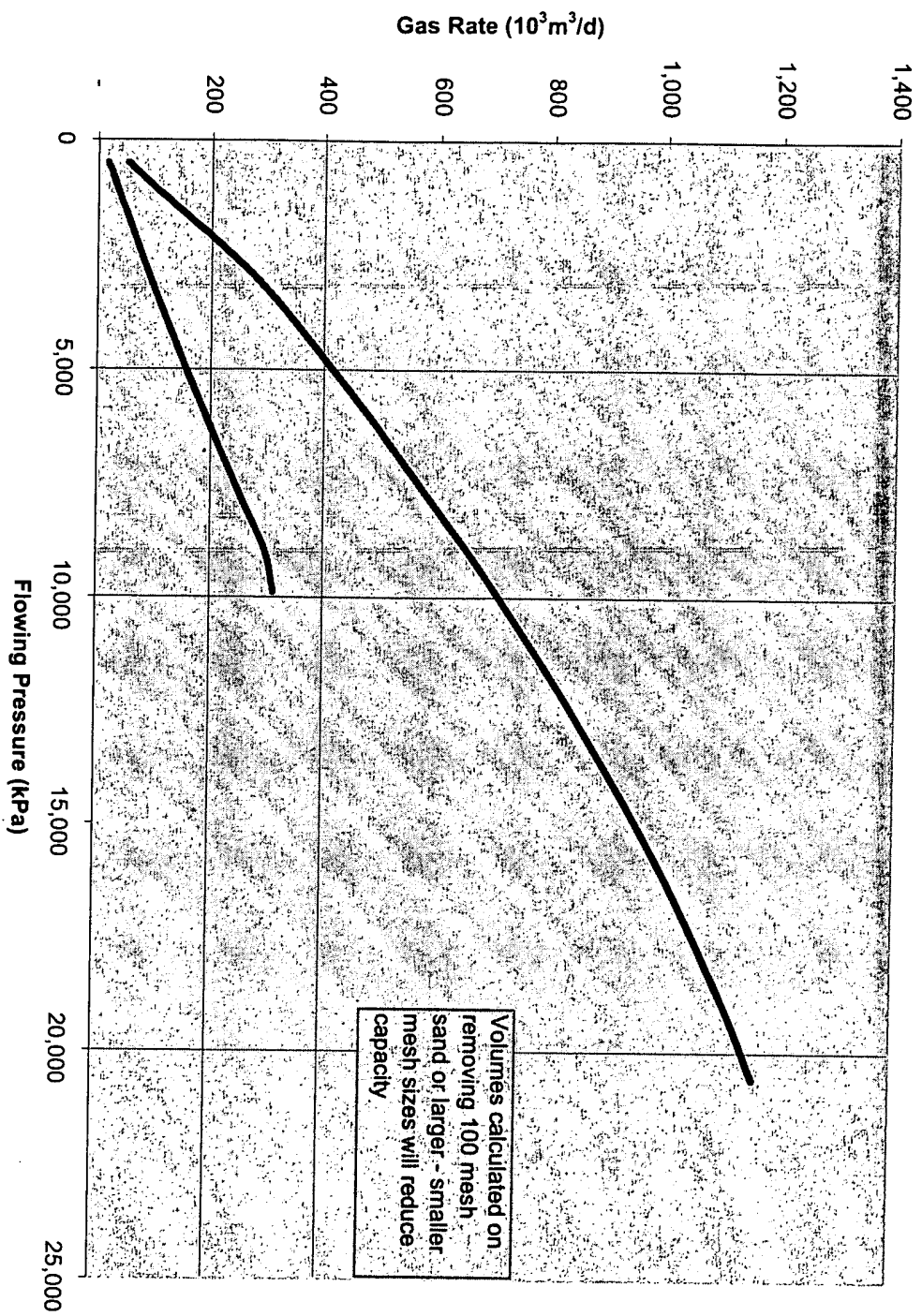


Typical
Installation
(Passive)

Fig. 2

DESANDER MAXIMUM THROUGHPUT VOLUMES

FIG. 3



— 10" 1500 ANSI
- - - 8" 600 ANSI